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Linguistic Abilities Related to Word Reading in Persian and Swedish

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Abstract

Previous studies have found that phonological processing and vocabulary predict word reading. However, their predictive powers may vary according to reading experience and across scripts with different levels of transparency. In this study, the relationship between phonological processing, decoding, vocabulary and word reading was explored in two different alphabetic languages: Persian (a non-Latin script) and Swedish (a Latin script). Standardised tests in both languages were used. Participants comprised 26 Persian-Swedish bilingual (biscriptal) children in school grades 4–9. Rapid automatic naming (RAN), phonological and semantic fluency, non-word reading and vocabulary were all significantly associated with word reading in Persian, whereas phonemic awareness, RAN, phonological fluency and non-word reading were significantly associated with word reading in Swedish. The findings have been compared with previous research and the educational implications are discussed.

Keywords: phonological processing, phonemic awareness, RAN, non-word reading, vocabulary, word reading predictors, predictors, and bilingual biscriptal children.

Alphabetic scripts vary in level of transparency and syllabic structure. A shallow orthography has a consistent one-to-one correspondence between graphemes and phonemes, whereas a deep orthography has an inconsistent relationship, and each grapheme could correspond to one or several phonemes. Decoding is considered to be the first important step in early reading development and involves sounding out letters by mapping each grapheme onto its corresponding phoneme. Decoding words can be more difficult and develop more slowly for children in deep orthographies regarding inconsistencies (Seymour, 2003). Syllabic structure could also play an important role (particularly in non-word reading) in decoding. It is more challenging to acquire the grapheme-phoneme correspondence rules in a language with a complex syllable structure with many closed syllables, initial and final consonant clusters, compared to languages with a simple syllable structure with few consonant clusters and open syllables (Seymour, 2003).

A number of linguistic skills are important and are involved in reading, "such as parsing, bridging and discourse building; decoding in the absence of these skills is not

reading….decoding is also of central importance in reading, for without it, linguistic comprehension is of no use" (Hoover and Gough, 1990: 128). Thus, poor decoding can also lead to poor reading comprehension (Nation, 2006), which subsequently has a negative effect on children's reading achievements in different subjects at school.

Factors such as orthographic depth and reading experience can impact on the power of linguistic abilities that predict word reading attainment (Bowey, 2005). A growing body of research has examined phonemic awareness and rapid automatic naming (RAN) and how they may predict bilingual children's word reading across different orthographies (e.g., Bellocchi, et al., 2017; Ziegler, et al., 2010). An analysis of bilingual children's linguistic abilities related to word reading in both languages can be enlightening as different scripts can be compared in the same group, which is not possible in cross-language studies (e.g., Vaessen et al., 2010; Everatt et al., 2010). Most previous studies have focused on bilinguals reading in one of the languages (e.g., Chiappe et al., 2002). Studies exploring bilingual reading development in the participants with two languages have either analysed two non-Latin scripts such as Arabic and Hebrew (e.g., Bishara & Weiss, 2017), two Latin scripts such as English and Spanish (e.g., Miller et al., 2006), or one alphabetic and one non-alphabetic script such as English and Chinese (e.g., Tong & McBride-Chang, 2010). English is often one of the languages (either first language (L1) or second language (L2)) chosen in many studies (e.g., Pasquarella et al., 2014). Most of these studies have used non-standardised tests in one of the languages (e.g., Arab-Moghaddam and Sénéchal, 2001).

Furthermore, most research has focused on children in the early stages of reading acquisition (i.e., up to Grade 2) (e.g., Caravolas et al., 2012). More research is needed on bilingual children's reading across different school grades and in the later stages of reading development. There is also a need to expand our knowledge on what may contribute to bilingual reading development for students learning to read in scripts that are more diverse, as is the case in, for example, Latin and non-Latin scripts.

This study explored phonological processing, decoding, vocabulary and their associations with word reading in a group of Persian-Swedish bilingual (biscriptal) children in school grades 4 to 9. Standardised tests were used for all measures in each language, respectively. In the schools, the participants' teaching language was Swedish and they were given only one hour of Persian mother tongue instruction per week.

Regarding orthographic depth, Swedish is considered a semi-transparent script, while Persian varies in levels of transparency. Vowelised Persian (short vowels marked by diacritics) is considered to have a shallow orthography, while the devowelised form is considered to have an opaque orthography (short vowels are not marked by diacritics in texts). This study may expand previous research by analysing the associations between phonemic awareness, RAN, phonological and semantic fluency, non-word reading, vocabulary and word reading in these two orthographies.

The paper considered one of the most dominant models in word reading. The relationships between phonological processing, decoding, vocabulary and word reading were studied across languages with different orthographic depths and in both monolingual and bilingual children.

Following this, reading acquisition across different orthographies and characteristics of Persian and Swedish orthographies are discussed.

Dual-route model

One of the most influential word reading models is the dual-route model. Coltheart (2005) viewed word reading as a process that entails transforming letter strings into phonological codes or meaning. The dual-route theory suggests that two main routes are used in word reading: the phonological and the orthographic routes. The phonological route is a prerequisite for reading acquisition and is probably more effective for recognising non-words or unfamiliar words as they can be decoded through a phonological system that involves applying the grapheme-phoneme correspondence rules for translating print into pronunciation. The orthographic route is more effective and assists reading processes by mapping the print to semantic representations, particularly in reading familiar words, and is important for recognising irregular words (Castles, 2006; Coltheart et al., 2001). The self-teaching hypothesis (e.g., Share, 1995) further developed the dual-route model by explaining how the phonological route could contribute to the development of the orthographic route. According to this hypothesis, word reading primarily relies on applying the grapheme-phoneme correspondence rules (i.e., using the phonological route), which develops and becomes more "lexicalised" during reading acquisition with more reading experience and increased orthographic knowledge. Thus, children gradually move from this demanding phase to a more effective reading strategy in which they store and access orthographic information that is specific to each word. In such cases, the rapid and accurate acquisition of orthographic representations is important. The ability to effectively use graphic-phoneme correspondence considerably influences the acquisition of orthographic representations. Share (1995) argued that successful decoding is primarily important in reading words that lead to the development of orthographic knowledge through reading experience, as well as the development of knowledge such as the expansion of syntax, semantics and pragmatics. Orthographic and linguistic knowledge play important roles during the decoding of ambiguity. On the orthographic route, the reader recognises whole words or segments of words in a mental orthographic lexicon, including lexical spelling information about a word (Coltheart, 2005). In line with this view, Nation and Castles (2017) argued that the effect of phonological decoding on reading decreases with the print experience, while the influence of orthographic access increases.

Phonological processing and word reading

Researchers have investigated different aspects of phonological processing in relation to word reading. In a meta-analysis, Melby-Lervåg and colleagues (2012) reviewed the role of implicit and explicit phonological skills, such as phonemic awareness (PA), rime awareness (RA) and phonological memory, and their associations with children's word reading development. Implicit skills include RAN tasks, which require rapid retrieval of stored lexical representations related to some stimuli, such as rapid naming of objects, digits, colours or letters (Wolf & Bowers, 1999). However, explicit tasks, such as phonemic awareness and rime awareness, require the analysis of a word's phonological structure and the ability to manipulate phonemes in words (Melby-Lervåg et al., 2012). Phonemic awareness refers to awareness of a word's phonological representations and the ability to manipulate the position of phonemes to create new words (Wren, 2000). Studies on word reading development have pinpointed letter knowledge (LK), phonemic

awareness and RAN to be solid predictors of early word reading (Wolf & Bowers, 1999; Wren, 2000; Muter et al., 2004; Lervåg, Bråten, & Hulme, 2009; Caravolas et al., 2012). LK refers to naming letters and understanding different graphic representations of letters, as in upper and lower cases. This knowledge, when combined with learning the grapheme-phoneme correspondences, comprises part of the alphabetic principle (Puranik et al., 2011; Wren, 2000; Melby-Lervåg et al., 2012). Melby-Lervåg et al., (2012) identified phonemic awareness making a significant contribution to individual variation in early word reading development when controlling for rime awareness and verbal short-term memory. They also found that once children get some reading practice, knowledge of printed words could further assist the development of phonemic awareness (Melby-Lervåg et al., 2012). RAN is also a unique longitudinal predictor of word reading development (Caravolas et al., 2012). Some scholars have also claimed that phonemic awareness is related to reading accuracy, while RAN mainly contributes to reading speed (e.g., Moll et al., 2014).

Many studies have mainly focused on English orthography. The generalisability of these studies to other languages with more shallow orthographies has been questioned (Share, 2008). In recent decades, scholars have studied how various aspects of phonological processing predict reading in different scripts.

Phonological processing, decoding, vocabulary and word reading in different orthographies in monolingual and bilingual children

Phonemic Awareness (PA). Studies of monolingual children suggest that phonemic awareness' contribution to word reading varies depending on the orthographic depth (for reviews, see, for example, Sadeghi & Everatt, 2018). The research that explored the effect of phonemic awareness on word reading in shallow orthographies have demonstrated that there is a significant predictor, particularly in early reading acquisition (Caravolas et al., 2012; Ziegler et al., 2010; Vaessen et al., 2010; Moll et al., 2014). However, its predictive power decreases after early reading development in shallow orthographies, while it continues to be important in deep orthographies (Roman et al., 2009; Ziegler et al., 2010; Caravolas et al., 2012; Sadeghi & Everatt, 2018). For example, Furnes and Samuelsson (2010) showed that the predictive influence of phonological awareness decreases after grade 1 in Norwegian and Swedish, while its effect remains in English. The same pattern has been observed in bilingual reading development. For example, Bellocchi and colleagues (2017) found that phonemic awareness in Italian was not a significant predictor after grade 1, whereas it has been shown to be a significant predictor in deep orthographies, such as English, in upper grades (Saiegh-Haddad & Geva, 2008).

Studies of non-Latin alphabetic scripts in monolingual Arabic and Persian, regardless of whether a vowelised or non-vowelised script was used which could impact the level of orthographic transparency, found that phonemic awareness significantly influenced word reading accuracy in Arabic from pre-school to age 11 (Taibah & Haynes, 2011; Abu-Rabia, 1995) and word reading speed in Persian from grades 2–5 (Sadeghi et al., 2016). However, after Sadeghi and colleagues (2016) had controlled for grades, neither a significant nor a strong relationship was found between phonemic awareness and word reading speed, implying that the influence of phonemic awareness on reading speed decreased with later reading development. In addition, studies have shown that the effect was greater when word reading accuracy was investigated compared with word reading speed (Elshikh, 2012; Saiegh-Haddad, Geva, 2008). Studies of Arabic bilinguals

found that the effect of phonemic awareness can also vary depending on the nature of the tasks (Farran, 2012).

Rapid Automatised Naming (RAN). Some studies have shown that RAN plays a more important role in word reading in shallow compared to deep scripts (De Jong & Van der Leij, 1999; Georgiou et al., 2008; Landerl & Wimmer, 2008). Nevertheless, an analysis of previous research indicated that RAN is a powerful predictor of word reading, regardless of the level of transparency, in the reading development of both monolinguals (Moll et al., 2014; Vaessen et al., 2010; Lervåg et al., 2009; Caravolas, et al., 2012) and bilinguals (Bellocchi, Tobia, & Bonifacci, 2017; Comeau et al., 1999; Erdos, et al., 2010). Some scholars have argued that RAN contributes more to reading speed than reading accuracy (e.g., Moll et al., 2014) and that alphanumeric tasks (digits/letters) may be more influential than non-alphanumeric tasks (colours/objects) in relation to word recognition (Lervåg et al., 2009; Schatschneider et al., 2004). These claims have been tested in cross-linguistic studies. For example, Ziegler and colleagues (2010) found a weak or non-existent relationship between non-alphanumeric RAN and word reading speed in Latin scripts with different orthographic depths (Ziegler, et al., 2010).

A stronger correlation between alphanumeric RAN and word reading compared to non-alphanumeric RAN and word reading has also been observed among non-Latin scripts in Arabic and Persian monolingual (Taibah & Haynes, 2011; Smythe et al., 2008) and bilingual studies (Gholamain & Geva, 1999; Elshikh, 2012), regardless of whether word accuracy or speed was examined.

Phonological decoding. Phonological decoding is a prerequisite for learning the orthographic representations of words (Share, 1995) and in subsequently establishing an orthographic lexicon (Marinelli et al., 2015). Previous research and meta-analysis supported a strong correlation between phonological decoding (non-word reading) and word reading in scripts with different orthographic depth in monolinguals (Swanson et al., 2003; Lervåg et al., 2009; Vaessen et al., 2010; Høien-Tengesdal & Tønnessen, 2011; De Jong & Van der Leij, 1999) and bilinguals (Swanson et al., 2008; Erdos, et al. 2010) across different grades. This is also in line with Persian and Arabic monolingual (Smythe et al., 2008; Mannai & Everatt, 2005; Taibah & Haynes, 2011; Abu-Rabia, 1995; Rahbari et al., 2007) and bilingual studies (Gholamain & Geva, 1999; Elshikh, 2012; Saiegh-Haddad, Geva, 2008; Farran, 2012) in both early and later reading development.

Vocabulary. Knowledge of vocabulary has been found to facilitate word reading acquisition by promoting the connections between orthographic, phonological and semantic representations in children's lexicon (Nation and Snowling, 1998; Plaut et al., 1996). In the word reading process, semantic knowledge and orthographic and phonological representations interact with each other (Coltheart, 2005).

Investigations of vocabulary in some Latin script-based studies demonstrated that it was not a reliable predictor of word reading in monolinguals (Ziegler, et al., 2010; Caravolas, et al., 2012) and bilinguals (Erdos, et al., 2010) in the early reading acquisition stage. However, vocabulary was found to contribute to word reading in later reading development in monolinguals (e.g., Vellutino et al., 2007) and bilinguals (Proctor et al., 2012) in Latin scripts with varying orthographic depths.

In contrast to the results from Latin script-based studies, Persian monolingual (Rahbari et al., 2007; Sadeghi et al., 2016) and bilingual (Arab-Moghaddam & Sénéchal, 2001) studies found that vocabulary was an important contributor to reading both vowelised and devowelised words in grades 2 to 5.

Semantic information is regarded as an important element of word reading across different orthographies (McBride, 2017). The role of semantics in word reading can partly be understood through the role of morphology. Morphemes are defined as the smallest meaningful linguistic units in words. Different types of morphemes such as derivational morphemes and inflectional morphemes can be added to the roots of words. The rules of morphology vary across different languages (McBride, 2017). Studies have shown that good readers also have good knowledge of morphology (e.g., Rispens, McBride-Chang and Reitsma, 2008). Understanding derivational morphology has been found to correlate with better reading abilities for children in later reading development who learn to read in Indo-European languages (Deacon and Kirby, 2004) such as Persian and Swedish. Being able to read and understand morphologically complex words is particularly crucial for the development of vocabulary knowledge and reading comprehension in older children (for a review, see Carlisle & Kearns, 2017).

Reading development in different orthographies

Previous studies have shown that reading acquisition varies across orthographies. In a cross-linguistic study, Seymour et al. (2003) investigated the differences in early reading development in 13 European languages. The analyses demonstrated that word reading develops faster in shallow orthographies (e.g., Italian) compared to semi-transparent (e.g., Swedish) and deep orthographies (e.g., English). The findings outlined that key linguistic features such as *syllabic structure* and *orthographic depth* can affect reading development. The representation of phonemes in writing also impacted reading acquisition (Seymour, 2005). For example, short vowels are only present in Persian and Arabic in the textbooks of lower graders and are then removed later from the textbooks. Taibah & Haynes (2011) investigated the transition from reading words with diacritics to reading words without short vowels in a group of monolingual Arabic children. They found that Arabic monolinguals (pre-school and Grade 1) could read vowelised words and that phonemic awareness had a strong influence on word reading at this stage. The strong power of phonemic awareness gradually declined from preschool through grade 2 when the children shifted to reading words without short vowels. Children from grades 2 to 3 could recognise words without short vowels and their reading accuracy increased. However, phonemic awareness regained significance in the third grade, which the authors explained as being related to the importance of mapping graphemes to phonemes when reading words without diacritical marks. The authors concluded that children at this stage are forced to depend on inadequate phonological information when identifying words and recognising their meanings.

Characteristics of Persian and Swedish orthographies

The two languages of interest in this study were Persian and Swedish. Both are alphabetic Indo-European languages. Swedish has 29 letters and is a Latin-based script, which is written from left to right. Swedish has nine vowels and 20 consonants and all the vowels are represented by

letters. Swedish has a semi-transparent script, meaning that some graphemes (e.g., *g*) can be pronounced using different phonemes (e.g., */g/* and */j/)* and some phonemes (e.g., /ɧ/) can be represented by different graphemes (e.g., *stj, sk, skj* and *sj*) (Rosenqvist et al., 2007; "Swedish orthography", 2019). In addition, all except two vowels are written using one letter. /ɛ/ is written as *ä* or *e* and /o/ is represented by an *å* or *o* (Olofsson, 2003). Swedish has a rather complex syllable structure (Seymour, et al., 2003) as up to three consonant clusters can be found before and/or after vowels ((C) (C) (C) V (C) (C) (C) e.g., *språk* (*language*)) ("Swedish", 2021).

Persian has 32 letters: 28 letters are in common with Arabic letters and the remaining do not exist in Arabic. Persian has a non-Latin script and is written from right to left (Baluch, 2006: 367). Persian has six vowels (three short vowels and three long vowels). The short vowels are written with diacritics and the long vowels are represented by letters (Baluch, 2006). The diacritics are only presented to inexperienced readers. They are absent from textbooks after grade 1 (Rahbari & Sénéchal, 2009) and are not used in regular texts. However, long vowels are always written. There is a very consistent relationship between graphemes and phonemes in Persian (Baluch, 2006). Each grapheme is only represented by one phoneme (Arab-Moghaddam & Sénéchal, 2001). Persian is considered a very shallow script when short vowels are represented or when words contain only long vowels and consonants (Baluch, 2006). However, words comprising unmarked short vowels are opaque. Thus, Persian has a deep orthography when the short vowels are missing. Persian has three syllable structures: CV, CVC and CVCC and consonant clusters are only allowed at the end of words (Zarifian et al., 2015) (e.g. ,*mard* (*man*)), i.e., Persian has a less complex syllable structure than Swedish, which allows up to three consonant clusters. For more information about Persian and Swedish orthographies see Johansson (2022).

The study

Previous studies focusing on the reading development of biscriptal children have either investigated two non-Latin scripts, two Latin scripts or one alphabetic and one non-alphabetic language. Many studies have analysed either L1 or L2. In studies including both languages, non-standardised tests have often been used in one of the languages. Most studies have focused on English as L1 or L2. Furthermore, most studies have included children in the early reading acquisition phase (i.e., children in Grades 1–2). Linguistic abilities and their relationships to word reading have been found to vary across orthographies and reading development. This study may offer more knowledge on the reading development of biscriptal children in a non-Latin (Persian) and Latin (Swedish) script and how phonological processing, decoding and vocabulary are associated with word reading in these two scripts in the later stage of reading development (grades 4 to 9). In Sweden, Persian is regarded as one of the top ten most common languages spoken by minorities. Around 60% of Persian-Swedish children receive mother tongue instruction in grades 1–9 (SOU, 2019).

Research questions

The present paper addressed the following research questions:

1. How do phonological processing, decoding and vocabulary relate to word reading in Persian in a group of bilingual biscriptal children?
2. How do phonological processing, decoding and vocabulary relate to word reading in Swedish in a group of bilingual biscriptal children?
3. How do bilingual biscriptal children perform word reading in Persian and Swedish?

The current report was part of a larger project that investigated children's linguistic abilities and writing in Persian and Swedish. This paper mainly explored the relationships among phonological processing, decoding, vocabulary, and word reading in these two orthographies.

Procedure

After receiving permission from the Swedish Ethical Review Authority (approval number/ID: 2016/177-31Ö) to conduct this research, the project announcement, including the criteria for participating in the study and the possibility to withdraw, was sent out to schools and advertised on social media and Persian radio channels in Sweden. About 1200 people, including Persian mother tongue teachers, special educational teachers, and school principals were contacted in Sweden. Most participants were found on Facebook. The project and the tasks were explained to both parents and the participants. Parents provided written informed consent for their children's participation. The older participants also signed informed consent and the younger participants gave their oral consent. The time and location of meetings were chosen together with the participants and their parents. The meetings took place in schools, homes, and libraries. The participants were assessed by the author. The test sessions were divided into two to three sessions. Some children, especially the older participants, did not have the possibility to be visited three times. Therefore, they did the tasks within one or two sessions. The sessions were terminated as soon as the participant got tired or distracted. The Latin square design was used in the order of the screening tasks. Participants were randomly assigned to different groups. Some started with the screening tasks in Persian and others began with the Swedish tasks. One participant in grade 7 did not finish all the semantic fluency tasks in Persian. Therefore, her answers were excluded from the analysis of this task in Persian. The rest of the participants finished all tasks in both languages.

Participants

Eleven Persian-Swedish bilingual children in grades 4–5 and fifteen children in grades 6–9 participated. The children ranged in ages from 10 to 15 (mean age 12.6) at the time of assessment. The sample consisted of 13 girls and 13 boys. All children spoke, understood, read, and wrote both Persian (Farsi/Dari) and Swedish. Both parents were Persian L1 speakers. The participants spoke mainly Persian at home and received mother tongue instruction at schools (around one hour each week). They had attended the Swedish school system for at least three years prior to participating in this project. On average, the participants had been in Sweden for eight years at the time of testing and had participated in Swedish schools for 5.5 years. Eight

participants had started their education in Iran or Afghanistan before they came to Sweden. Two children in grade 7 had previously been diagnosed with dyslexia by speech and language therapists. For more information about the participants, see Johansson (2022).

Test materials

The standardised Persian screening tasks (Kormi-Nouri & Moradi, 2009) (except RAN-digits) used in this project were designed for children between 7 to 11 years old (grades 1–5) in Iran. Standardised tests in Persian for children in grades 6–9 were not available. Therefore, the tests for grade 5 were also used for 6-9 graders. However, the children's knowledge in Swedish was tested according to their school level (grades 4–9).

In Persian, the manual's (Kormi-Nouri & Moradi, 2007) Mean (M) and Standard Deviation (SD) were only available for grades 4 and 5, and half of the Swedish tests were different for students in grades 4–5 and students in grades 6–9. Therefore, the participants were divided into two groups: grades 4–5 and grades 6–9. The participants' M and SD were computed for each group separately and were based on participants' raw scores in each group respectively (see Tables 1 and 2).

Measures: Persian and Swedish tasks

Word reading. The Persian word reading subtest consisted of high to low frequency devowelised words. 120 Persian devowelised words (with only one correct answer each) were written on three cards (40 words on each card). The words were between 2 to 10 letters long (one to five syllables). For each card, the participant was required to read as many words as he/she could correctly within 2 minutes. The Cronbach's alpha for this test was reported 0.98 (Kormi-Nouri & Moradi, 2007).

The Swedish subtest comprised 36 words for students in grades 4–5 (max score = 36) and 46 words for students in grade 6 or higher (max score= 46). The participant was presented one word at a time for 200 milliseconds on the computer screen. The words were from 2 to 12 letters long (one to four syllables). The reliability scores provided in the manual were 0.90 for grade 4 and 0.93 for grade 8. In addition, the validity scores reported were 0.89 (grade 4) and 0.79 (grade 8) p= <.001 (Høien, 2007).

Phonemic Awareness: Phoneme deletion task. The participants listened to 30 Persian words. They were instructed to repeat each word without a specified phoneme (e.g., *zard* (yellow) without *r*). The test was stopped after 2 minutes. The total number of correct responses was counted. The maximum score for this task was 30. Cronbach's alpha was reported 0.96 (Kormi-Nouri & Moradi, 2007).

In Swedish, the Magnusson & Nauclér (1993) task was used for younger children (grades 4 and 5) and LOGOS (Høien, 2011) for older participants (grades 6-9). The participants were required to listen to each word and repeat it without a specific phoneme (e.g., *film* without *m*). Høien (2007) reported the reliability score of 0.95 and the validity score of 0.30 (p= <.001) for grade 8.

Rapid Automatised Naming: RAN-Digit. This test did not exist in Persian. Therefore, the Swedish RAN-digit subtest of LOGOS (Høien, 2007) was used in both languages. Five numbers were written in different orders on the paper. In order to be able to compare the results between languages, the numbers were written once with Roman numbers and once with Arabic numbers on a piece of paper. The paper was shown to the participants and they were asked to name the numbers as fast as possible. The raw score was the number of seconds that it took the participant to name all the numbers. The reliability score that was reported by Høien (2007) for the reaction time was 0.96 in grade 8 with the validity scores of 0.37 (in grade 4, p= <.001) and 0.24 (in grade 8, p=<0.005).

Verbal fluency: Phonological fluency and semantic fluency. The Persian phonological fluency test consisted of three letters. The student had one minute to come up with as many words as he could, which started with a specific letter. The semantic fluency task comprised 6 categories (e.g., body parts, colours). The participants had one minute to come up with as many words as they could for each category (for more information, see Kormi-Nouri and colleagues, 2012).

The Swedish phonological fluency test was similar to the Persian task and contained three letters. However, the semantic fluency test only contained one category (animals) (Carlsson, 2009).

Phonological decoding: Non-word and pseudo-word reading. Participants were required to read 40 Persian non-words/pseudo-words quickly within two minutes. They consisted of three to eight letters. The number of syllables per word varied from one to four. The raw score for each participant was the total number of correct answers. The words were devowelised for this part too. Therefore, all acceptable pronunciations were counted correctly. The task had a maximum score of 40. The Cronbach's alpha for the 40 words in this test was 0.98 (Kormi-Nouri & Moradi, 2007).

The Swedish non-word reading subtest contained 24 words for students in Grades 4–5 (max score= 24) and 28 words for students in grade 6 or higher (max score= 28). One word at a time was shown to the participant. The student had 5 seconds to read each word. The non-words were from three to ten letters long and they were between one to four syllables. The reliability coefficient for this task was 0.91 (grade 4) and 0.92 (grade 8). Høien (2007) reported the validity scores of 0.83 (grade 4) and 0.78 (grade 8) p= <.001.

Vocabulary. The Persian test had 30 multiple-choice questions. The students listened to both the questions and the alternatives and were required to mark the correct answers. The task had a maximum score of 30 and was not time limited. Cronbach's alpha for this test was 0.87 (Kormi-Nouri & Moradi, 2007).

The DLS test had 40 multiple-choice questions for grades 4–6 (maximum score= 40) and 34 multiple-choice questions for grades 7–9 (maximum score 34) (Järpsten & Taube, 1997; Järpsten, 2002). The same procedure was conducted for these tests. The participants listened to the recording and were required to choose the correct answer without any time restriction. The reliability scores provided in the manual are 0.88 for grade 4, 0.91 for grades 5 and 6, 0.78 for grades 7-8, and 0.80 for grade 9.

Vocabulary tests in both languages were very similar in nature and consisted of questions such as "being 'wet' is the same as being…". Then four alternatives were provided such as *cold, dry, frozen, damp*. The student was asked to choose one of the options.

Statistical analysis

In order to provide some information to the readers about participants' performance levels in each language and task, their raw scores were compared with the Manuals' age norms (see Table 5), except for grades 6–9 in Persian as norms were only available up to grades 4–5. Therefore, the participants' performance in grades 6–9 in Persian was compared with the Manual's norms for grade 5.

According to Field (2017), the data are normally distributed in case the variables' z-skewness and z-kurtosis are between -1.96 and 1.96. Word reading in Persian and Swedish, as well as non-word reading and phonemic awareness in Swedish violated this assumption. Due to the small sample size and the lack of normal distribution in these variables, a non-parametric method, Spearman's rank order correlation, was used to investigate the relationship between linguistic abilities and word reading in each language. The participants' raw scores were used in the correlation analyses.

Results

Descriptive

The participants' performances across different grades in Swedish and Persian languages are presented in Tables 1 and 2.

Table 1

Descriptive Statistics Swedish Grades 4–9

	Grades 4–5		Grades 6–9	
	N	Mean (SD)	N	Mean (SD)
Word reading[a]	11	33.91 (1.38)	15	38.20 (10.66)
Phonemic Awareness[a]	11	10.73 (1.10)	15	11.47 (2.45)
Rapid Automatized Naming[b]	11	23.73 (2.72)	15	22.4 (3.46)
Phonological fluency[a]	11	22.36 (7.06)	15	23 (7.58)
Semantic fluency[a]	11	18.91 (3.75)	15	15 (3.53)
Non-word reading[a]	11	22.36 (1.29)	15	21.60 (5.29)
Vocabulary[a]	11	21.82 (6.31)	15	16.27 (8.22)

[a] Number of correct responses, [b]number of seconds.

Table 2

Descriptive Statistics Persian Grades 4–9

	Grades 4–5		Grades 6–9	
	N	Mean (SD)	N	Mean (SD)
Word reading[a]	11	56 (12.12)	15	62.47 (12.69)
Phonemic Awareness[a]	11	14.82 (5.08)	15	12.93 (6.23)
Rapid Automatized Naming[b]	11	43.27 (12.22)	15	31.8 (12.60)
Phonological fluency[a]	11	21.45 (5.94)	15	23.07 (6.12)
Semantic fluency[a]	11	67.73 (9.87)	14	75.86 (18.29)
Non-word reading[a]	11	19.36 (9)	15	23.67 (10)
Vocabulary[a]	11	18.82 (4.62)	15	23.27 (6.83)

[a] Number of correct responses, [b]number of seconds.

Correlations between phonological processing, decoding, vocabulary and word reading in Persian

Spearman's correlation was used to investigate the relationships between linguistic abilities and word reading in both languages (see Tables 3 and 4). The following guidelines were used in interpreting the strength of correlations between variables: small effect size r=.10 to 0.29, medium r= .30 to .49, and large r= .50 to 1.0 (Cohen, 1988).

Table 3

Spearman's correlation among the Persian variables

	1	2	3	4	5	6	7
1. Word Reading	1.00						
2. Phonemic Awareness	.36	1.00					
3. Rapid Automatized Naming	-.61**	-.16	1.00				
4. Phonological Fluency	.61**	.41*	-.67**	1.00			
5. Semantic Fluency	.51**	.43*	-.71**	.79**	1.00		
6. Non Word Reading	.88**	.25	-.58**	.63**	.41*	1.00	
7. Vocabulary	.60**	.40*	-.72**	.70**	.81**	.50*	1.00

**p <.01; *p <.05.

A closer analysis of Persian measures in Table 3 demonstrated strong and significant correlations between non-word reading, RAN, phonological fluency, semantic fluency, vocabulary, and word reading.

Correlations between phonological processing, decoding, vocabulary and word reading in Swedish

Table 4

Spearman's correlation among the Swedish variables

	1	2	3	4	5	6	7
1. Word Reading	1.00						
2. Phonemic Awareness	.63**	1.00					
3. Rapid Automatized Naming	-.40*	-.44*	1.00				
4. Phonological Fluency	.42*	.10	.00	1.00			
5. Semantic Fluency	-.01	.02	-.10	.33	1.00		
6. Non Word Reading	.53**	.35	-.02	.41*	.10	1.00	
7. Vocabulary	.19	.28	-.03	.13	.13	.20	1.00

**p <.01; *p <.05.

An examination of Swedish variables in Table 4 showed a strong and significant relationship between phonemic awareness, non-word reading and word reading. In addition, a medium but significant relationship was found between RAN, phonological fluency, and word reading.

Participants' word reading performance in Persian and Swedish

Comparison of results with manual's norms in both languages demonstrated that there were many more participants who performed under -1 SD in Persian, 21, than in Swedish, 6, reading tasks even though more than half of the group was in grade 6 or higher and their results in Persian were compared with the manual's norms for children in grade 5. Table 5 also exhibited the number of children who performed -1 SD on each task in both languages. In total, 12 participants performed -1 SD in one or more tasks in both languages; among those, only one participant performed -1 SD or below in all tasks in both languages and he did not have a diagnosis at the time of assessment.

Table 5

Total number of participants performing below -1 SD from mean

	SWE Measures	PER Measures	PER and SWE
Word reading	6	21	4
Phonemic Awareness	3	23	3
Rapid Automatised Naming	NA	NA	NA
Phonological fluency	9	4	2
Semantic fluency	8	4	1

Non-word reading	7	22	6
Vocabulary	13	12	5

Note. NA, Not Available; PER, Persian; SWE, Swedish.

Discussion

The present paper explored phonological processing, decoding and vocabulary in relation to word reading in one semi-transparent Latin script (Swedish) and one deep non-Latin script (Persian) in a group of 26 bilingual biscriptal children. RAN, phonological fluency and non-word reading were significantly associated with word reading in both languages. In addition, phonemic awareness was significantly associated with word reading in Swedish, whereas semantic fluency and vocabulary knowledge were significantly associated with word reading in Persian.

Regarding phonological processing, significant relationships (a strong correlation in Persian and a medium correlation in Swedish) were found between RAN, phonological fluency and word reading in both orthographies. This is in accordance (in line) with studies demonstrating significant associations between RAN and word reading in Latin scripts with various orthographic depth for monolinguals (e.g., Vaessen et al., 2010) bilinguals (e.g., Bellocchi, Tobia, & Bonifacci, 2017; Comeau et al., 1999) and in non-Latin scripts for Persian and Arabic monolinguals (e.g., Taibah & Haynes, 2011) and bilinguals (e.g., Gholamain & Geva, 1999). RAN is associated with word reading and reflects rapid access to and retrieval of phonological codes from the long-term memory (Wagner and Torgesen, 1987). Some scholars have shown that RAN can be more related to reading speed than accuracy (e.g., Schatschneider et al., 2004). In the present study, it was not possible to disentangle reading speed and accuracy as both aspects formed part of the same measure. The raw scores used in the analysis were based on the number of words that the participants accurately read within a specific time limit. Future studies on bilingual reading could investigate the impact of RAN on reading accuracy and speed separately. Regarding the importance of RAN, some studies (e.g., Kirby et al., 2010) have found that RAN can be a more powerful predictor of word reading in later reading development for monolingual students. This pattern was confirmed in this study with bilingual students in a later stage of reading development (Grades 4–9).

In this study, phonemic awareness was only significantly and strongly associated with word reading in Swedish, which was somewhat surprising since previous studies (e.g., Furnes & Samuelsson, 2010; Vaessen et al., 2010) have shown that phonemic awareness' predictive power decreases after grade 1. Cross-linguistic studies have shown that in shallow orthographies, due to the consistent relationship between graphemes and phonemes, children learn this rule at an earlier stage and, as a result, their reading development is faster compared to deep orthographies (e.g., Moll et al., 2014; Caravolas et al., 2012). The present results suggest that the participants' knowledge of phonemic awareness, which is about understanding how to differentiate between separate phonemes (Ehri, 2005), and which is a requirement for learning the grapheme-phoneme correspondences (Castles, 2006), was also important in reading Swedish words in later reading development. The discrepancy between these results and previous studies could be explained by the type of tasks (e.g., deletion versus blending) and linguistic level (phonemes versus syllables) used. For example, Bellocchi and colleagues (2017) used a syllabic blending task to assess phonemic awareness. In this study, a phoneme deletion task was used, which is shown to be a

reliable way of examining phonemic awareness (Hulme et al., 2002) and can be more strongly correlated with word reading than blending tasks (Farran, 2012). Furthermore, tasks examining larger phonological units (syllables) are easier than tasks examining smaller phonological units (phonemes) (McBride-Chang, 2004). The significant relationship that was found between phonemic awareness and word reading in Swedish but not in Persian can also be explained through these two languages' orthographic characteristics. The reader has access to all the phonological representations in Swedish whereas this information is partly missing when the short vowels are removed in Persian. Therefore, the reader cannot rely on the phonological representations to read the words accurately in Persian which could explain the lack of significant association between phonemic awareness and word reading in Persian.

This study revealed a strong and significant association between non-word reading and word reading in both languages. This is in line with previous studies that found significant relationships between these two variables in Persian and Arabic monolinguals (e.g., Taibah & Haynes, 2011; Rahbari et al., 2007) and bilinguals (e.g., Gholamain & Geva, 1999; Elshikh, 2012) from early reading acquisition to grade 6. A similar pattern has been found in Latin scripts. For example, Høien-Tengesdal & Tønnessen (2011) found significant correlations between non-word reading and word reading in monolingual Swedish and Norwegian children in grades 3–5. According to the self-teaching hypothesis (Share, 1999), the ability to apply the grapheme-phoneme correspondence rules is a prerequisite for developing the orthographic knowledge necessary for skilled word reading. In line with this theory, the present results confirmed the importance of decoding in relation to word reading and suggest that a good decoder is also more likely to develop good word reading skills. This was also shown in Table 5, in which most participants performed within the expected age norms in both non-word reading and word reading in Swedish, whereas most participants performed -1 SD below the expected age norms in both non-word reading and word reading in Persian.

Some predictors, such as semantic fluency and vocabulary, were only significantly and strongly associated with word reading in Persian. This suggests that semantic knowledge is probably important in reading words in Persian, which is in line with previous Persian studies showing that vocabulary influenced word reading for both monolinguals (Rahbari et al., 2007; Sadeghi et al., 2016) and bilinguals (Arab-Moghaddam & Sénéchal, 2001). It has also been claimed that vocabulary knowledge plays a more significant role when the reader has only succeeded in partially decoding a word (Wang, Castles & Nickels, 2012; Wang et al, 2013). Diacritics were not used to represent short vowels in the word reading tasks. Thus, the readers did not have access to all phonological information about the target word. In such cases, an advanced vocabulary could help the reader to recognise and read words. Some research (e.g., Fiez, 2000) has also shown that word reading in deep orthographies mainly depends on lexical knowledge, whereas in shallow orthographies, it is possible to depend more on grapheme-phoneme correspondences. This could explain the different outcome for vocabulary knowledge and word reading in Swedish and Persian. Regarding the dual route, the results suggest that participants need to access a stored lexical representation when reading words, particularly familiar words, in Persian. However, in a semi-transparent script such as Swedish, the participants possibly did not need to know the meaning of words to the same extent when reading them. This is in accordance with the orthographic depth hypothesis (Katz and Frost, 1992), which states that the orthographic characteristics of each language determine the procedure(s) that readers rely on to read words. According to this hypothesis, readers of shallow orthographies use grapheme-phoneme

correspondence rules to read words, whereas inconsistent relationships between graphemes and phonemes in deep orthographies probably encourage readers to access the meaning of words and convert the orthographic input lexicon in their minds into a phonological output lexicon. This is consistent with the results of the present paper. A similar pattern has also been observed in cross-linguistic studies (e.g., Marinelli et al., 2015).

The results from Table 5 suggest that, as a group, most participants achieved the expected results in word reading tasks in Swedish and, on an individual level, only six participants performed -1 SD below the mean. This is in accordance with studies showing that second language learners do not have a problem reading words in their L2 (e.g., Lesaux and Siegel, 2003). However, the results showed that on a group level, most participants had weak word reading in Persian and 21 out of 26 performed -1 SD below the mean, meaning that children had difficulty reading words in their mother tongue. The participants had attended the Swedish school system for quite a long time, on average, 5.5 years. Also, most of the participants (18) had started their school education in Sweden and had consequently received limited mother tongue instruction. It was therefore not surprising to find that they had better word reading in Swedish than in Persian. They had received more reading instruction in Swedish and read most subjects, except languages, in this language. In a similar vein, Gholamian and Geva (1999) also stated that it was easier to find Persian-English bilingual children in Canada who had better reading performance in English than in Persian.

Regarding the participants' word reading performance, a conclusion could possibly be drawn that their word reading was automated in Swedish, but probably not in Persian. The level of orthographic transparency could possibly have affected the differences found between linguistic abilities associated with word reading in Persian and Swedish. Cross-linguistic studies have shown that orthographic depth could also play an important role in reading acquisition (Seymour, 2005). In shallow orthographies, children learn about the relationship between graphemes and phonemes at an earlier stage, have higher reading fluency and accuracy and, consequently, their reading development is faster compared with deep orthographies (e.g., Seymour et al., 2003). It might take more time for Persian readers to be efficient readers due to the characteristics of Persian orthography and they probably need to be provided with more reading instruction than in a semi-transparent orthography such as Swedish.

Conclusion and Implications

The present paper suggests that RAN, verbal fluency and non-word reading play important roles in Persian and Swedish word reading in a group of bilingual and biscriptal students beyond early reading instruction. However, phonemic awareness correlated significantly only with word reading in Swedish, while vocabulary correlated significantly only with word reading in Persian. Based on previous research and the fact that short vowels were absent in Persian word reading tasks, it was expected that vocabulary knowledge would contribute to Persian word reading as knowing the meaning of words could help reading Persian words. It was surprising to find a significant and strong relationship between phonemic awareness and word reading in Swedish, as previous studies demonstrated that the predictive power of phonemic awareness decreases with reading experience. More research in this area is required in order to explore the association between phonemic awareness and word reading among older bilinguals in Swedish.

Most participants had a weak performance in Persian word reading tasks. Limited mother tongue instruction and resources have been raised in many countries globally (e.g., Kamwendo 2008; Salö et al., 2018; Bingöl, 2013; Sinjur et al., 2012; Wang & Phillion 2009). There should be greater focus on bilinguals' mother tongue instruction. It forms part of their identity and their right to be able to learn to read and develop literacy in both scripts.

It is often stated that bilinguals lag their monolingual counterparts at school. In this study, Persian-Swedish bilinguals in grades 4–9 achieved the expected results in Swedish word reading. The number of years attending school in Sweden and the fact that most participants had started their school education in Sweden could have contributed to these results. However, the results suggested that most participants were behind their monolingual peers in Persian reading achievements, which could reflect the minimal amount of reading instruction they had received in Persian. Mother tongue teaching should increase and teachers could focus more on reading instruction and vocabulary knowledge development so that students can improve these skills and potentially become more efficient readers in Persian.

The significant relationship between non-word reading and word reading in both languages suggests that it is potentially important to continue mastering grapheme-phoneme correspondences, even in the later stages of reading development in both orthographies. It cannot be taken for granted that students will learn these correspondence rules without being specifically taught. Some students might start their education in their home country and start attending Swedish schools after an early reading development stage. These students might be at risk of never receiving any specific teaching to learn these rules in Swedish; some students might learn on their own, but not all of them. However, when students start their education in Swedish, like most of the participants here, we cannot assume that just because a student has learned the grapheme-phoneme connection in a Latin script, they will automatically know these rules in a non-Latin script, too. Thus, they will probably also need to receive specific teaching in their L1 in order to learn this rule.

Vocabulary knowledge is important in word reading and reading comprehension. Thus, special attention should also be directed towards students who perform poorly in vocabulary knowledge tasks in both languages. In such cases, teachers of Swedish as a second language and mother tongue teachers could cooperate and provide extra help and education for these students. Teachers could also encourage students to both listen and try to read stories in both languages in order to improve their vocabulary knowledge.

Limitations

The author is aware of the small sample size and the large age span among the participants. The task of identifying bilingual biscriptal participants was challenging, even though one year was spent looking for these participants and many people were contacted. Participation in this project was voluntary and the number of participants could have been higher if they had not been required to meet all the criteria, particularly being able to read and write in Persian. The results demonstrated that the word reading of most of the participants was age appropriate and within the expected results in Swedish, but not in Persian. This might explain the difficulty in finding more participants as it is challenging for this group to read and write in Persian, which is not surprising, as they had received very limited instruction in Persian.

One of the strong points of the current paper is the usage of standardised tests to investigate word reading, and linguistic abilities related to it, in both languages. It is not possible to find standardised tests that are identical since they are designed in different countries with different contexts. Thus, an attempt was made to find tests that were as similar as possible in both scripts. However, there were also some small differences between the tests. For example, there were more categories in the semantic fluency test in Persian than in Swedish, which could mean that there was higher strain in Persian than in Swedish to perform this task, which may have affected the results.

Regarding the sample size and age span between the participants (grades 4–9), the results cannot be generalised and should be interpreted with caution. In future studies, it could be valuable to replicate this study with a larger and more homogenous sample. This would enable the use of more advanced statistical methods to explore the relations between phonological processing, decoding, vocabulary and word reading for older children in these two orthographies and investigate the developmental perspective between younger and older participants.

References

Abu-Rabia, S. (1995). Learning to read in Arabic: Reading, syntactic, orthographic and working memory skills in normally achieving and poor Arabic readers. *Reading Psychology*, *16*(4), 351–394. https://doi.org/10.1080/0270271950160401

Arab-Moghaddam, N., & Sénéchal, M. (2001). Orthographic and phonological processing skills in reading and spelling in Persian/English bilinguals. *International Journal of Behavioral Development*, *25*(2), 140–147. https://doi.org/10.1080/01650250042000320

Baluch, B. (2006). Persian orthography and its relation to literacy. *Handbook of Orthography and Literacy*, 365–376. Erlbaum.

Bellocchi, S., Tobia, V., & Bonifacci, P. (2017). Predictors of reading and comprehension abilities in bilingual and monolingual children: A longitudinal study on a transparent language. *Reading and Writing*, *30*(6), 1311–1334. https://doi.org/10.1007/s11145-017-9725-5

Bingöl, A. S. (2013). Mother tongue instruction policies towards Turkish migrant children in Europe. *Procedia-Social and Behavioral Sciences*, *70*, 1016–1023. https://doi.org/10.1016/j.sbspro.2013.01.153

Bishara, S., & Weiss, I. (2017). Correlation between phonological and morphological awareness and the reading of punctuated and non-punctuated words in Arabic as first language and Hebrew as second language. *Cogent Education*, *4*(1). https://doi.org/10.1080/2331186X.2017.1322028

Bowey, J. A. (2005). Predicting individual differences in learning to read. In M. J. Snowling & C. H. (Eds.), *The science of reading: A handbook* (pp. 155–172). Blackwell. https://doi.org/10.1002/9780470757642.ch9

Caravolas, M., Lervåg, A., Mousikou, P., Efrim, C., Litavskỳ, M., Onochie-Quintanilla, E., Salas, N., Schöffelová, M., Defior, S., & Mikulajová, M. (2012). Common patterns of prediction of literacy development in different alphabetic orthographies. *Psychological Science*, *23*(6), 678–686. https://doi.org/10.1177/0956797611434536

Carlisle, J. F., & Kearns, D. M. (2017). Learning to read morphologically complex words. *Theories of Reading Development*, *15*, 191–214.

Carlsson, S. (2009). Barn och ungdomars prestationer och svarsmönster på ordflödestest. *Examensarbete Från Logopedprogrammet. Karolinska Institutet, Institutionen För Klinisk Vetenskap, Intervention Och Teknik, Logopedi*, *171*, 77. [Children and adolescents' performance and response patterns on word flow test. *Degree Project From The Speech Program*. *Karolinska Institutet, Department of Clinical Science, Intervention and Technology, Speech Therapy, 171, 77*.]

Castles, A. (2006). The dual route model and the developmental dyslexias. *London Review of Education*, *4*(1), 49–61. https://doi.org/10.1080/13603110600574454

Chiappe, P., Siegel, L. S., & Wade-Woolley, L. (2002). Linguistic diversity and the development of reading skills: A longitudinal study. *Scientific Studies of Reading*, *6*(4), 369–400. https://doi.org/10.1207/S1532799XSSR0604_04

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences.* (2nd ed.). Lawrence Erlbaum Associates.

Coltheart, M., Rastle, K., Perry, C., Langdon, R., & Ziegler, J. (2001). DRC: A Dual Route Cascaded Model of Visual Word Recognition and Reading Aloud. *Psychological Review*, *108*(1), 204–256. https://doi.org/10.1037/0033-295X.108.1.204

Coltheart, M. (2005). Modeling reading: The dual-route approach. *The Science of Reading: A Handbook*, 6–23. https://doi.org/10.1002/9780470757642.ch1

Comeau, L., Cormier, P., Grandmaison, É., & Lacroix, D. (1999). A longitudinal study of phonological processing skills in children learning to read in a second language. *Journal of Educational Psychology*, *91*(1), 29–43. https://doi.org/10.1037/0022-0663.91.1.29

Deacon, S. H., & Kirby, J. R. (2004). Morphological awareness: Just "more phonological"? The roles of morphological and phonological awareness in reading development. *Applied Psycholinguistics*, *25*(2), 223–238. https://doi.org/10.1017/S0142716404001110

De Jong, P. F., & Van der Leij, A. (1999). Specific contributions of phonological abilities to early reading acquisition: Results from a Dutch latent variable longitudinal study. *Journal of Educational Psychology*, *91*(3), 450-476. https://doi.org/10.1037/0022-0663.91.3.450

Ehri, L. C. (2005). Learning to read words: Theory, findings, and issues. *Scientific Studies of Reading*, *9*(2), 167–188.

Elshikh, M. (2012). *Psycho-linguistic predictors of L1-Arabic and L2-English reading and writing skills for Arabic speaking children*. Doctoral thesis: University of Surrey.

Erdos, C., Genesee, F., Savage, R., & Haigh, C. A. (2010). Individual differences in second language reading outcomes. *International Journal of Bilingualism*, *15*(1), 3–25. https://doi.org/10.1177/1367006910371022

Everatt, J., Ocampo, D., Veii, K., Nenopoulou, S., Smythe, I., al Mannai, H., & Elbeheri, G. (2010). Dyslexia in biscriptal readers. In N. Brunswick, S. McDougall, & P. de Mornay Davies (Eds.), *Reading and dyslexia in different orthographies* (pp. 221-246). Psychology Press.

Farran, L. K., Bingham, G. E., & Matthews, M. W. (2012). The relationship between language and reading in bilingual English-Arabic children. *Reading and Writing*, *25*(9), 2153–2181. https://doi.org/10.1007/s11145-011-9352-5

Field, A. (2017). *Discovering statistics using IBM SPSS statistics: North American edition*. Sage.

Fiez, J. A. (2000). Sound and meaning: How native language affects reading strategies. *Nature Neuroscience*, *3*(1), 3–5. https://doi.org/10.1038/71078

Furnes, B., & Samuelsson, S. (2010). Predicting reading and spelling difficulties in transparent and opaque orthographies: A comparison between Scandinavian and US/Australian children. *Dyslexia*, *16*(2), 119–142. https://doi.org/10.1002/dys.401

Georgiou, G. K., Parrila, R., & Papadopoulos, T. C. (2008). Predictors of word decoding and reading fluency across languages varying in orthographic consistency. *Journal of Educational Psychology*, *100*(3), 566-580. https://doi.org/10.1037/0022-0663.100.3.566

Gholamain, M., & Geva, E. (1999). Orthographic and cognitive factors in the concurrent development of basic reading skills in English and Persian. *Language Learning*, *49*(2), 183–217. https://doi.org/10.1111/0023-8333.00087

Høien-Tengesdal, I., & Tønnessen, F.-E. (2011). The relationship between phonological skills and word decoding. *Scandinavian Journal of Psychology*, *52*(1), 93–103. https://doi.org/10.1111/j.1467-9450.2010.00856.x

Høien, T. (2007). *Logoshandbok. Diagnostisering av dyslexi och andra lässvårigheter* [Handbook. Diagnosis of dyslexia and other reading disorders]. Logometrica AS.

Hoover, W. A., & Gough, P. B. (1990). The simple view of reading. *Reading and Writing*, *2*(2), 127–160.

Hulme, C., Hatcher, P. J., Nation, K., Brown, A., Adams, J., & Stuart, G. (2002). Phoneme awareness is a better predictor of early reading skill than onset-rime awareness. *Journal of Experimental Child Psychology*, *82*(1), 2–28. https://doi.org/10.1006/jecp.2002.2670

Johansson, B. (2022). *Two languages, two scripts: Bilingual and biscriptal children with and without reading difficulties read and write in Persian (L1) and Swedish (L2)* (Doctoral dissertation, Umeå University).

Järpsten, B., & Taube, K. (1997). *DLS för skolår 4-6. [DLS for school years 7–9 and grade 1 of secondary school.]*. Hogrefe Psykologiförlaget AB.

Järpsten, B. (2002). *DLS för Skolår 7–9 och 1 i gymnasiet. [DLS for school years 7–9 and grade 1 of secondary school.]*. Hogrefe Psykologiförlaget AB.

Kamwendo, G. H. (2008). The bumpy road to mother tongue instruction in Malawi. *Journal of Multilingual and Multicultural Development*, *29*(5), 353–363. https://doi.org/10.1080/01434630802147858

Katz, L., & Frost, R. (1992). The reading process is different for different orthographies: The orthographic depth hypothesis. *Advances in Psychology* (Vol. 94, pp. 67–84). Elsevier. https://doi.org/10.1016/S0166-4115(08)62789-2

Kirby, J. R., Georgiou, G. K., Martinussen, R., Parrila, R., Bowers, P., & Landerl, K. (2010). Naming speed and reading: From prediction to instruction. *Reading Research Quarterly*, *45*(3), 341–362. https://doi.org/10.1598/RRQ.45.3.4

Kormi-Nouri, R., Moradi, A. R., Moradi, S., Akbari-Zardkhaneh, S., & Zahedian, H. (2012). The effect of bilingualism on letter and category fluency tasks in primary school children: Advantage or disadvantage? *Bilingualism: Language and Cognition*, 15(2), 351-364.

Kormi-Nouri, R, & Moradi, A.R. (2009). *Reading and dyslexia test*. Jahad University Teacher Education Branch, Tehran.

Kormi-Nouri, R. & Moradi, A.R. (2007). *Final report for standardisation of NAMA Scale: The study of reading and dyslexia in bilingual and monolingual children.* A joint research project by the University of Tehran and the Ministry of Education in Iran.

Landerl, K., & Wimmer, H. (2008). Development of word reading fluency and spelling in a consistent orthography: An 8-year follow-up. *Journal Of Educational Psychology*, *100*(1), 150–161. https://doi.org/10.1037/0022-0663.100.1.150

Lervåg, A., Bråten, I., & Hulme, C. (2009). The cognitive and linguistic foundations of early reading development: A Norwegian latent variable longitudinal study. *Developmental Psychology*, *45*(3), 764. https://doi.org/10.1037/a0014132

Lesaux, N. K., & Siegel, L. S. (2003). The development of reading in children who speak English as a second language. *Developmental Psychology*, *39*(6), 1005. https://doi.org/10.1037/0012-1649.39.6.1005

Magnusson, E., & Nauclér, K. (1993). *Bedömning av språklig medvetenhet hos förskolebarn och skolbarn*. Pedagogisk design. [*Assessment of linguistic awareness in preschool children and school children*. Educational design.]

Mannai, H. al, & Everatt, J. (2005). Phonological processing skills as predictors of literacy amongst Arabic speaking Bahraini children. *Dyslexia*, *11*(4), 269–291. https://doi.org/10.1002/dys.303

Marinelli, C. V., Romani, C., Burani, C., & Zoccolotti, P. (2015). Spelling acquisition in English and Italian: A cross-linguistic study. *Frontiers in Psychology*, *6*. 1843 https://doi.org/10.3389/fpsyg.2015.01843

McBride, C. (2017). Early literacy across languages. *Theories of Reading Development*, 55–74.

McBride-Chang, C. (2004). *Children's literacy development*. Oxford University Press.

Melby-Lervåg, M., Lyster, S.-A. H., & Hulme, C. (2012). Phonological skills and their role in learning to read: A meta-analytic review. *Psychological Bulletin*, *138*(2), 322–352. https://doi.org/10.1037/a0026744

Miller, J. F., Heilmann, J., Nockerts, A., Iglesias, A., Fabiano, L., & Francis, D. J. (2006). Oral language and reading in bilingual children. *Learning Disabilities Research & Practice*, *21*(1), 30–43. https://doi.org/10.1111/j.1540-5826.2006.00205.x

Moll, K., Ramus, F., Bartling, J., Bruder, J., Kunze, S., Neuhoff, N., et al. (2014). Cognitive mechanisms underlying reading and spelling development in five European orthographies. *Learning and Instruction*, *29*, 65–77. https://doi.org/10.1016/j.learninstruc.2013.09.003

Muter, V., Hulme, C., Snowling, M. J., & Stevenson, J. (2004). Phonemes, rimes, vocabulary, and grammatical skills as foundations of early reading development: Evidence from a longitudinal study. *Developmental Psychology*, *40*(5), 665–681. https://doi.org/10.1037/0012-1649.40.5.665

Nation, K. (2006). Children's reading comprehension difficulties. In M. J. Snowling & C. Hulme (Eds.), *The science of reading: A handbook* (pp. 227-247). Blackwell.

Nation, K., & Castles, A. (2017). Putting the learning into orthographic learning. *Theories of Reading Development*, 147–168. https://doi.org/10.1075/swll.15.09nat

Nation, K., & Snowling, M. J. (1998). Individual differences in contextual facilitation: Evidence from dyslexia and poor reading comprehension. *Child Development*, *69*(4), 996–1011. https://doi.org/10.1111/j.1467-8624.1998.tb06157.x

Olofsson, A. (2003). The dyslexic reader and the Swedish language. In: Goulandris, N. (Ed.), *Dyslexia: Crosslinguistic comparisons* (pp. 137-156). Whurr Publishers.

Pasquarella, A., Deacon, H., Chen, B. X., Commissaire, E., & Au-Yeung, K. (2014). Acquiring orthographic processing through word reading: Evidence from children learning to read French and English. *International Journal of Disability, Development and Education*, *61*(3), 240–257. https://doi.org/10.1080/1034912X.2014.932579

Plaut, D. C., McClelland, J. L., Seidenberg, M. S., & Patterson, K. (1996). Understanding normal and impaired word reading: Computational principles in quasi-regular domains. *Psychological Review*, *103*(1), 56. https://doi.org/10.1037/0033-295X.103.1.56

Proctor, C. P., Silverman, R. D., Harring, J. R., & Montecillo, C. (2012). The role of vocabulary depth in predicting reading comprehension among English monolingual and Spanish–English bilingual children in elementary school. *Reading and Writing*, *25*(7), 1635–1664. https://doi.org/10.1007/s11145-011-9336-5

Puranik, C. S., Lonigan, C. J., & Kim, Y.-S. (2011). Contributions of emergent literacy skills to name writing, letter writing, and spelling in preschool children. *Early Childhood Research Quarterly*, *26*(4), 465–474. https://doi.org/10.1016/j.ecresq.2011.03.002

Rahbari, N., & Sénéchal, M. (2009). Lexical and nonlexical processes in the skilled reading and spelling of Persian. *Reading and Writing*, *22*(5), 511–530. https://doi.org/10.1007/s11145-008-9122-1

Rahbari, N., Sénéchal, M., & Arab-Moghaddam, N. (2007). The role of orthographic and phonological processing skills in the reading and spelling of monolingual Persian children. *Reading and Writing*, *20*(5), 511–533. https://doi.org/10.1007/s11145-006-9042-x

Rispens, J. E., McBride-Chang, C., & Reitsma, P. (2008). Morphological awareness and early and advanced word recognition and spelling in Dutch. *Reading and Writing*, *21*(6), 587–607. https://doi.org/10.1007/s11145-007-9077-7

Roman, A. A., Kirby, J. R., Parrila, R. K., Wade-Woolley, L., & Deacon, S. H. (2009). Toward a comprehensive view of the skills involved in word reading in Grades 4, 6, and 8. *Journal of Experimental Child Psychology*, *102*(1), 96–113. https://doi.org/10.1016/j.jecp.2008.01.004

Rosenqvist, Håkan., Bannert, Robert., & Branderud, P. (2007). *Uttalsboken: Svenskt uttal i praktik och teori*. 1 uppl. Natur & Kultur.

Sadeghi, A., Everatt, J., & McNeill, B. (2016). A simple model of Persian reading. *Writing Systems Research*, *8*(1), 44–63. https://doi.org/10.1080/17586801.2014.1003768

Sadeghi, A., & Everatt, J. (2018). Phonological awareness development in speakers of languages other than English. In G. T. Gillon (Ed.), *Phonological awareness: From research to practice* (pp. 57–73). Guilford Publications.

Saiegh-Haddad, E., & Geva, E. (2008). Morphological awareness, phonological awareness, and reading in English–Arabic bilingual children. *Reading and Writing*, *21*(5), 481. https://doi.org/10.1007/s11145-007-9074-x

Salö, L., Ganuza, N., Hedman, C., & Karrebæk, M. S. (2018). Mother tongue instruction in Sweden and Denmark. *Language Policy*, *17*(4), 591–610. https://doi.org/10.1007/s10993-018-9472-8

Schatschneider, C., Fletcher, J., Francis, D., Carlson, C., & Foorman, B. (2004). Kindergarten prediction of reading skills: A longitudinal comparative analysis. *Journal of Educational Psychology*, *96*, 265–282. https://doi.org/10.1037/0022-0663.96.2.265

Seymour, P. H. (2005). Early reading development in European Orthographies. In M. J. Snowling & C. Hulme (Eds.), *The science of reading: A handbook* (pp. 296 –315). Blackwell. https://doi.org/10.1002/9780470757642.ch16

Seymour, P. H., Aro, M., & Erskine, J. M. (2003). Foundation literacy acquisition in European orthographies. *British Journal of Psychology*, *94*(2), 143–174. https://doi.org/10.1348/000712603321661859

Share, D. L. (1995). Phonological recoding and self-teaching: Sine qua non of reading acquisition. *Cognition*, *55*(2), 151–218. https://doi.org/10.1016/0010-0277(94)00645-2

Share, D. L. (1999). Phonological recoding and orthographic learning: A direct test of the self-teaching hypothesis. *Journal of Experimental Child Psychology*, *72*(2), 95–129. https://doi.org/10.1006/jecp.1998.2481

Share, D. L. (2008). On the Anglocentricities of current reading research and practice: The perils of overreliance on an "outlier" orthography. *Psychological Bulletin*, *134*(4), 584-615. https://doi.org/10.1037/0033-2909.134.4.584

Sinjur, A., Devjak, T., Blažič, M., & Krajnčan, M. (2012). Pupils with immigrant backgrounds–policies and practices of mother tongue tuition in Slovenia. *Pedagoska obzorja* 3–4: 170-183.

Smythe, I., Everatt, J., Al-Menaye, N., He, X., Capellini, S., Gyarmathy, E., & Siegel, L. S. (2008). Predictors of word-level literacy amongst Grade 3 children in five diverse languages. *Dyslexia*, *14*(3), 170–187. https://doi.org/10.1002/dys.369

SOU. (2019). *För flerspråkighet, kunskapsutveckling och inkludering. Modersmålsundervisning och studiehandledning på modersmål.* Betänkande av Utredningen om modersmål och studiehandledning på modersmål i grundskolan och motsvarande skolformer [*For multilingualism, knowledge development and inclusion. Native language teaching and study guidance in native language.* Report of the Inquiry into mother tongue and study guide in mother tongue in primary school and corresponding school forms]. Stockholm: Utbildningsdepartementet [*Ministry of Education*].

Swanson, H. L., Rosston, K., Gerber, M., & Solari, E. (2008). Influence of oral language and phonological awareness on children's bilingual reading. *Journal of School Psychology*, *46*(4), 413–429. https://doi.org/10.1016/j.jsp.2007.07.002

Swanson, H. L., Trainin, G., Necoechea, D. M., & Hammill, D. D. (2003). Rapid naming, phonological awareness, and reading: A meta-analysis of the correlation evidence. *Review of Educational Research*, *73*(4), 407–440. https://doi.org/10.3102/00346543073004407

Swedish orthography. (2019, December 29). In *Wikipedia*. https://en.wikipedia.org/w/index.php?title=Swedish_orthography&oldid=933023366

Swedish. (2021, June 05). In *Wikipedia*. https://sv.wikipedia.org/wiki/Svenska

Taibah, N. J., & Haynes, C. W. (2011). Contributions of phonological processing skills to reading skills in Arabic speaking children. *Reading and Writing*, *24*(9), 1019–1042. https://doi.org/10.1007/s11145-010-9273-8

Tong, X., & McBride-Chang, C. (2010). Chinese-English biscriptal reading: Cognitive component skills across orthographies. *Reading and Writing*, *23*(3), 293–310. https://doi.org/10.1007/s11145-009-9211-9

Vaessen, A., Bertrand, D., Tóth, D., Csépe, V., Faísca, L., Reis, A., & Blomert, L. (2010). Cognitive development of fluent word reading does not qualitatively differ between transparent and opaque orthographies. *Journal of Educational Psychology*, *102*(4), 827-842. https://doi.org/10.1037/a0019465

Vellutino, F. R., Tunmer, W. E., Jaccard, J. J., & Chen, R. (2007). Components of reading ability: Multivariate evidence for a convergent skills model of reading development. *Scientific Studies of Reading*, *11*(1), 3–32. https://doi.org/10.1080/10888430709336632

Wagner, R. K., & Torgesen, J. K. (1987). The nature of phonological processing and its causal role in the acquisition of reading skills. *Psychological Bulletin*, *101*(2), 192–212. Scopus. https://doi.org/10.1037/0033-2909.101.2.192

Wang, H.-C., Castles, A., & Nickels, L. (2012). Word regularity affects orthographic learning. *The Quarterly Journal of Experimental Psychology*, *65*, 856–864. https://doi.org/10.1080/17470218.2012.672996

Wang, H.-C., Nickels, L., Nation, K., & Castles, A. (2013). Predictors of orthographic learning of regular and irregular words. *Scientific Studies of Reading*, *17*(5), 369–384. https://doi.org/10.1080/10888438.2012.749879

Wang, Y., & Phillion, J. (2009). Minority language policy and practice in China: The need for multicultural education. *International Journal of Multicultural Education*, *11*(1), 138-152. https://doi.org/10.18251/ijme.v11i1.

Wolf, M., & Bowers, P. G. (1999). The double-deficit hypothesis for the developmental dyslexias. *Journal of Educational Psychology*, *91*(3), 1-24. https://doi.org/10.1037/0022-0663.91.3.415

Wren, S. (2000). *The cognitive foundations of learning to read: A framework*. Southwest Educational Development Laboratory, Austin TX.

Zarifian, T., Modarresi, Y., Tehrani, L. G., & Kazemi, M. D. (2015). Phonetic and phonological acquisition in Persian speaking children. *On Monolingual and Bilingual Speech*, *2015*, 430-438.

Ziegler, J. C., Bertrand, D., Tóth, D., Csépe, V., Reis, A., Faísca, L., Saine, N., Lyytinen, H., Vaessen, A., & Blomert, L. (2010). Orthographic depth and its impact on universal predictors of reading: A cross-language investigation. *Psychological Science*, *21*(4), 551–559. https://doi.org/10.1177/0956797610363406

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